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FACULTY WORKING  
PAPER NO. 963

On the Incremental Benefits of Using  
Consolidated Accounting Data to Predict  
Conglomerate Earnings

*Paul Newbold*  
*Peter A. Silhan*

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## On the Incremental Benefits of Using Consolidated Accounting Data to Predict Conglomerate Earnings

Paul Newbold, Professor  
Department of Economics

Peter A. Silhan, Assistant Professor  
Department of Accountancy

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## ABSTRACT

The purpose of this paper is to explore the possibility that investors and financial analysts could effectively use consolidated-based forecasts of conglomerate earnings even though they are generally less accurate than segmented-based forecasts. To accomplish this we discuss the concept of conditional efficiency and test for it on a set of ARIMA forecasts.

The results indicate that forecasts based on segmented sales and margins not only dominate parallel forecasts based on consolidated sales and margins, but they are also conditionally efficient. This implies that composite forecasts would not provide benefits beyond those of the segmented forecasts.



On the Incremental Benefits of Using  
Consolidated Accounting Data to Predict Conglomerate Earnings

INTRODUCTION

Segment reporting may have changed the way that investors and financial analysts approach the task of predicting conglomerate earnings. Instead of relying solely on consolidated sales and earnings, they can now rely on segmented sales and earnings as well.

Forecasting research has shown that forecasts based on consolidated (CN) data are generally inferior to forecasts based on segmented (SG) data. However, these results do not preclude the possibility that CN forecasts could be used in combination with SG forecasts. Indeed, it is possible that such composite forecasts would be even more accurate than the various forecasts taken individually.

The purpose of this paper is to examine the incremental predictive benefits of CN sales and earnings relative to SG sales and earnings. Given that SG forecasts are generally more accurate, we test the proposition that CN forecasts, nevertheless, may add information to the forecasting process.

#### RELATED LITERATURE

The value of disaggregated accounting disclosures, particularly SG sales, has been demonstrated in a number of empirical studies. Kinney [14] and Collins [8] assessed indirectly the ability of financial analysts to make more accurate predictions of corporate earnings with the use of line-of-business data. In essence, they predicted SG earnings by multiplying predicted SG sales by either predicted CN margins or predicted SG margins. These SG forecasts were then compared to benchmark forecasts based solely on CN earnings.

In both studies, the models using SG sales and CN margins outperformed the benchmarks. However, the models using CN margins were not outperformed by the models using SG margins. From these results, it was concluded that the primary benefits of segment reporting accrue to SG sales, not SG profits (Collins [8, p. 126]). Similar conclusions were reached by Emmanuel and Pick [10] with respect to British segmental data.

Barefield and Comiskey [2] evaluated the apparent effects of SG disclosures on the accuracy of income forecasts made by financial analysts. They found that after SG profit data were required by the Securities and Exchange Commission (SEC) in 1970, the average forecast errors of financial analysts were not affected.

Collins [7] devised trading rules based on SG forecasts and found again that SG sales could make an important difference in forecasting. In cases where the CN forecasts were lower than the SG forecasts, the trading strategy required that the security be purchased. Conversely, if the CN forecasts were higher than the SG forecasts, the security was sold short. In effect, he hypothesized that SG forecasts, which had not been disclosed to the public before the 1970 SEC requirements, represented inside information. Interestingly, the usefulness of SG profits data was not supported by the results.

Together, these studies imply that SG forecasts generally outperform CN forecasts, but the benefits of line-of-business reporting mainly accrue to revenue disclosures. However, the issue of conditional efficiency has not been addressed in the segmentation literature.<sup>1</sup>

#### CONDITIONAL EFFICIENCY

One strategy for the evaluation of a set of forecasts is comparison, in terms of squared error or absolute percentage error for example, with a competing set of predictions. Although such comparisons are certainly valuable, it is possible, as proposed by Granger and Newbold [12], to go further, exploiting the possibility of a combined, or composite, predictor, following for example Bates and Granger [4]. In addition to the determination

of which set of forecasts has performed best, this approach has two related advantages. First, it allows an assessment as to whether one set of forecasts contains any useful information that is not properly incorporated in the other. Second, it raises the possibility of a combined forecast that could be superior to various forecasts taken individually.

In the present context, denote by  $X_i$  the quantity to be predicted and by  $F_i^{CN}$  and  $F_i^{SG}$  the forecasts based on consolidated and segmented data. Consider now the linear regression

$$X_i = \alpha + \beta_1 F_i^{CN} + \beta_2 F_i^{SG} + \varepsilon_i \quad (1)$$

where  $\varepsilon_i$  is a random error term. Thus, if the CN forecasts contain no useful information not already incorporated in the SG forecasts,  $\beta_1$  in (1) should be zero. Given sets of forecasts, this hypothesis can easily be tested by a least squares fit of this regression model. Nelson [16] has used this approach in comparing forecasts of economic variables from econometric and simple time series models.

Now, if as is often reasonable, it can be assumed that the individual forecasts are efficient in the sense of Mincer and Zarnowitz [15], (1) can be simplified to the consideration of a composite forecast that is a weighted average of the two individual forecasts. Mincer-Zarnowitz efficiency requires the

forecasts to be unbiased with the correct variances. This can be viewed as the requirement that the regression of actual on forecast have intercept zero and slope unity. With this assumption we then have

$$X_i = \gamma F_i^{CN} + (1-\gamma) F_i^{SG} + \epsilon_i \quad (2)$$

or, equivalently,

$$(X_i - F_i^{SG}) = \gamma(F_i^{CN} - F_i^{SG}) + \epsilon_i \quad (3)$$

Thus, if the CN forecasts contain no useful information not already present in the SG forecast, then  $\gamma$  in (2) should be zero, and in the terminology of Granger and Newbold [12] the SG forecasts are said to be conditionally efficient with respect to the CN forecasts. Given the former, there would be nothing to be gained by also having the latter. This hypothesis is easily tested through the least squares fitting of (3).

Now, in an ideal world where the structures and parameters of the models generating the series were known precisely, the SG forecasts would indeed be conditionally efficient with respect to the CN forecasts. However, in practice, various data must be employed both to suggest the structure of a model and to estimate its parameters. Indeed, for the SG forecasts, several models have to be constructed. Our objective in this paper is to assess

whether or not, in these circumstances, the SG forecasts are conditionally efficient.

#### RESEARCH DESIGN

Quarterly and annual forecasts of net income were used in our study to test for the conditional efficiency of SG forecasts and the possibility that combining CN forecasts with SG forecasts might produce composite forecasts more accurate than the SG forecasts. Simulated mergers [18] were used to provide quarterly time series data for Box-Jenkins analysis [6]. In essence, multiple-segment firms were created by hypothetically merging single-segment firms. Since the component firms were in unrelated industries, the merged firms thus represent pure conglomerates.

By simulating conglomerate mergers, the methodological problems of segment ambiguities, interdivision transfers and common cost allocations were avoided. Actually, firms which diversify into unrelated industries tend to operate as self-sufficient divisions [9] and tend to have small corporate staffs [5] [17]. Thus by avoiding these side issues and controlling for data contamination the test for conditional efficiency was strengthened.

Data Sample

A COMPUSTAT sample of sixty non-regulated, domestically-registered, industrial single-product, calendar-year firms was used in the study. Each firm had four or less 3-digit SIC codes and was neither a holding company nor an owned subsidiary. These criteria ensured that the surrogate segments were, in fact, non-diversified and autonomous.

Next, the component segments were arranged in descending order by size of earnings. This ensured that there would be no dominant segments in the resulting conglomerates. Firms were then merged by simply adding together the component income streams in combinations of two, three, four, and five segments. In all, there were thirty 2-segment, twenty 3-segment, fifteen 4-segment, and twelve 5-segment conglomerates derived from the sixty 1-segment firms.

Sales, assets and earnings were the data of interest. Each firm reported quarterly sales and earnings and annual beginning assets for twelve consecutive years from 1967-I to 1978-IV. Profit margins were computed by dividing earnings by sales; returns on assets were computed by dividing earnings by total assets at the beginning of the calendar year.

### Forecasting Models

Multiplicative seasonal ARIMA models were used to project quarterly sales and profit margins.<sup>2</sup> Predicted quarterly CN sales were then multiplied by predicted quarterly CN margins to derive predicted CN earnings. Similarly, predicted SG sales were multiplied by predicted SG margins to derive predicted quarterly SG earnings. SG earnings were then pooled together to derive SG forecasts paralleling the CN forecasts. Both sets of forecasts predicted conglomerate earnings.

Next, the quarterly predictions were added together to derive annual CN and SG forecasts. Then, both quarterly and annual predictions were deflated by January 1 assets to control for size differences. Thus, the variables of interest in this study were CN return on assets and SG return on assets.

### EMPIRICAL RESULTS

We now turn to our empirical results for the prediction of conglomerate earnings. Multisegment firms consisting of from two to five segments were analyzed, for the three years 1976-78, and both quarterly and annual forecasts were examined.<sup>3</sup>

Consider, first, the estimation of model (1). Detailed results are reported in Tables 1 and 2. The null hypothesis of interest is that the CN forecasts contribute no useful information,

given that the SG forecasts are available. This is the hypothesis

$$H_0: \beta_1 \leq 0$$

which we test against the alternative that the CN forecasts should receive positive weight in a composite forecast, that is

$$H_1: \beta_1 > 0$$

The tables show the lowest significance levels at which the null hypothesis can be rejected against this alternative. From Table 1 we find for the first-quarter forecasts that there is only one case for which the null hypothesis is rejected at a significance level below 5%, and one other in which it is rejected at a level between 5% and 10%. A similar picture emerges from examination of the results for annual forecasts in Table 2. Here there is only one case for which the null hypothesis is rejected at the 5% level, and there are no other cases for which this hypothesis can be rejected at a significance level of 10% or less. In summary, then, these data fail to suggest strong evidence in support of the contention that the consolidated forecasts add useful information to the segmented forecasts.

The picture is radically different when we test the null hypothesis

$$H_0: \beta_2 \leq 0$$

against the alternative

$$H_1: \beta_2 > 0$$

For the quarterly forecasts, it emerges from Table 1 that this null hypothesis can be rejected at levels below 5% in eight of the fifteen cases, and at levels between 5% and 10% for one other case. The corresponding figures for the annual forecasts of Table 2 are five and three. This evidence suggests very strongly that the SG forecasts contain useful information not present in the CN forecasts.

Tables 3 and 4 present results for model (2), where it is assumed that the individual forecasts are efficient in the Mincer-Zarnowitz sense. Here the null hypothesis to be tested is again that the CN forecasts contain no useful information. Hence we test

$$H_0: \gamma \leq 0$$

against

$$H_1: \gamma > 0$$

From the tables it can be seen that on no occasion is the null hypothesis rejected at the 5% level.

Our analysis, then, has failed to find strong evidence against the hypothesis that the SG forecasts are conditionally efficient with respect to the CN forecasts.

#### IMPLICATIONS

The concept of conditional efficiency adds a new dimension to the way that investors and other decision makers might approach the task of deciding on how to fully utilize accounting information. Instead of framing such decisions in an either-or context, decision makers would also consider combinatorial uses of such information. This subtle shift in viewing information decisions could have important implications for providers and users of information.

Decisions to use consolidated data for predicting conglomerate earnings implicitly assume that forecasts based on segmented information are not conditionally efficient with respect to the consolidated information. We have demonstrated, however, that given the availability of segment-based forecasts the consolidated-based forecasts appear to have no incremental benefits in an income forecasting context. This evidence, of course, does not preclude the possibility that consolidated information could be used in other ways for other purposes.

#### Footnotes

<sup>1</sup>Several studies, however, have focused on the conditions under which the SG forecasts would be expected to outperform the CN forecasts [1] [3] [11] [13].

<sup>2</sup>Models were reidentified and reestimated for each set of univariate predictions.

<sup>3</sup>Since the quarterly data were grouped by calendar year, the one to four step-ahead quarterly predictions, which were aggregated into annual forecasts, represented calendar years.

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Table 1: Estimation of Model (1) for Quarterly Forecasts of Earnings

Number of Segments	Forecast Period	$\alpha$	$\beta_1$	$\beta_2$
2	1976	0.0033 (.037)	-0.1709 (.690)	1.0937 (.002)
	1977	0.0026 (.121)	-0.4569 (.897)	1.3080 (.000)
	1978	-0.0037 (.019)	0.7466 (.057)	0.3535 (.232)
3	1976	0.0012 (.276)	0.0593 (.396)	0.9991 (.000)
	1977	-0.0011 (.634)	0.5976 (.156)	0.4581 (.184)
	1978	-0.0043 (.968)	0.6293 (.047)	0.4971 (.062)
4	1976	0.0049 (.033)	0.1092 (.320)	0.7363 (.005)
	1977	-0.0001 (.516)	-0.0875 (.588)	1.0921 (.004)
	1978	-0.0016 (.681)	0.0879 (.409)	0.9151 (.002)
5	1976	0.0024 (.128)	-0.1249 (.725)	1.0905 (.001)
	1977	-0.0002 (.513)	-0.1919 (.625)	1.1994 (.010)
	1978	-0.0043 (.839)	0.1917 (.322)	0.9465 (.003)

Note: Figures in brackets are smallest significance levels at which it is possible to reject the null hypothesis that a parameter is zero against the alternative that it is positive.

Table 2: Estimation of Model (1) for Annual Forecasts of Earnings

Number of Segments	Forecast Period	$\alpha$	$\beta_1$		$\beta_2$
2	1976	0.0029 (.149)	0.2647 (.232)	0.7090 (.024)	
	1977	0.0024 (.152)	-0.4133 (.872)	1.3947 (.001)	
	1978	0.0009 (.388)	0.3026 (.337)	0.7406 (.160)	
3	1976	0.0026 (.185)	0.6702 (.032)	0.3238 (.160)	
	1977	0.0075 (.112)	-0.0172 (.511)	0.9095 (.068)	
	1978	0.0001 (.492)	0.6750 (.118)	0.3853 (.292)	
4	1976	0.0048 (.074)	0.3145 (.243)	0.5486 (.105)	
	1977	0.0006 (.427)	0.1711 (.343)	0.8865 (.027)	
	1978	0.0052 (.150)	-0.4794 (.776)	1.3275 (.012)	
5	1976	0.0046 (.104)	0.3758 (.179)	0.4880 (.074)	
	1977	0.0007 (.413)	-0.0070 (.508)	1.0522 (.007)	
	1978	0.0060 (.125)	-0.0151 (.511)	0.7939 (.057)	

Note: Figures in brackets are smallest significance levels at which it is possible to reject the null hypothesis that a parameter is zero against the alternative that it is positive.

Table 3: Estimation of Model (2) for Quarterly Forecasts of Earnings

Number of Segments	Forecast Period	$\gamma$	Number of Segments	Forecast Period	
				$\gamma$	$\gamma$
2	1976	-0.2398 (.753)	4	1976	0.0750 (.384)
	1977	-0.1556 (.712)		1977	-0.0991 (.676)
	1978	0.5246 (.138)		1978	-0.0121 (.521)
3	1976	-0.0598 (.589)	5	1976	-0.1325 (.711)
	1977	0.4848 (.141)		1977	-0.2077 (.724)
	1978	0.2485 (.229)		1978	-0.1991 (.812)

Note: Figures in brackets are smallest significance levels at which it is possible to reject the null hypothesis that a parameter is zero against the alternative that it is positive.

Table 4: Estimation of Model (2) for Annual Forecasts of Earnings

Number of Segments	Forecast Period	$\gamma$	Number of Segments	Forecast Period	$\gamma$
2	1976	0.1327 (.353)	4	1976	0.4360 (.191)
	1977	-0.1946 (.702)		1977	0.4184 (.160)
	1978	0.7338 (.125)		1978	0.0193 (.485)
3	1976	0.5600 (.067)	5	1976	0.4882 (.113)
	1977	0.5551 (.157)		1977	0.2544 (.237)
	1978	0.9371 (.066)		1978	0.4916 (.140)

Note: Figures in brackets are smallest significance levels at which it is possible to reject the null hypothesis that a parameter is zero against the alternative that it is positive.





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